# Chapter 6
# Reducing the Risk from Asbestos in the Built Environment During Natural Hazard Events

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**Abstract** Asbestos, in its natural state in the ground, poses a minimal risk to humans. This chapter discusses the nature of the risk which develops when Asbestos is mined, processed, and used and then subject to damage from hazards such as earthquakes, cyclones, floods, or tsunamis. The chapter explores how the presence of Asbestos-containing products, principally used for construction, and damage to the built environment by these hazards can significantly increase the threat from Asbestos to human health, with a high level of delay in negative health outcomes following even slight exposure. The chapter discusses current practice to address the Asbestos-disaster risk in relief and recovery, noting that these efforts may face challenges with funding and sustainability beyond the initial disaster response. The chapter outlines a process to address the Asbestos-disaster risk in preparedness and risk reduction, with an emphasis on raising awareness as to the nature of, and measures to address, this risk. The chapter concludes with a set of criteria for identifying where Asbestos-disaster risk reduction efforts should be targeted and calls for further work to reduce the risk from Asbestos as a result earthquakes, cyclones, floods, or tsunamis.

**Keywords** Risk · Asbestos · Natural hazards · Disasters · Built environment

## 6.1 Introduction

Asbestos is a term used to describe a group of six naturally occurring minerals. These minerals form long crystalline fibers that have high tensile strength; conduct electricity and heat poorly; do not expand when wet; are fire, heat, and corrosion resistant; are generally cheap to extract and process; and combine easily with other

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S. D'Amico, F. De Pascale (eds.), *Geohazards and Disaster Risk Reduction*,
Advances in Natural and Technological Hazards Research 51,
https://doi.org/10.1007/978-3-031-24541-1_6

construction materials. As a result, in many ways Asbestos can be seen as an ideal building material. It is because of this that it has had a centuries-long use in manufacturing, construction, and other sectors (Selikoff and Lee 1978).

At the same time, however, the WHO International Agency for Research on Cancer has concluded that all forms of Asbestos are carcinogenic, directly causing mesothelioma and cancer of the lung, larynx, and ovary, and linked to cancer of the pharynx, stomach, and colorectum (World Health Organization 2012). This has led to global efforts to ban its use.[1] The World Health Assembly requested WHO to carry out a global campaign for the elimination of all Asbestos-related diseases (World Health Organisation 2018). Of particular concern is the latency of Asbestos health impacts, which can manifest decades after even limited exposure (Frank and Joshi 2014).

From a disaster risk management perspective, materials including Asbestos provide a peculiar challenge. When not disturbed, that is not broken up or otherwise removed from the containment in which it is used, Asbestos poses minimal immediate threat.

However, when disturbed, for instance, being broken up when buildings are damaged during an earthquake or when flood-damaged buildings are deconstructed, fine Asbestos fibers can be released into the environment and pose a significant risk from inhalation, ingestion, or physical contact. Where the funds and means are available, this risk can be minimized through containment, removal, and disposal programs. These programs are based on appropriate training, the use of personal protection equipment, constructing containment structures around areas where Asbestos is being removed, and continuous dampening prior to eventual safe burial to reduce the risk of airborne Asbestos dust (Shelter Centre and ProAct Network 2015).

Unfortunately, these approaches are complex, expensive, difficult, and often impractical to implement, in every country after a disaster, due to the sheer scale of contamination, lack of resources, and focus on immediate lifesaving measures. The result is that search and rescue efforts, clearing debris, and removing damaged or destroyed buildings and Asbestos-containing equipment may expose assistance providers and the disaster-affected populations to a high level of exposure to Asbestos in the environment which may then continue for decades until, if ever, adequate cleanup measures are undertaken.

The aftermath of a series of earthquakes in late 2018 in and around Lombok, Indonesia, is a case in point. The earthquakes led to damage to, or destruction of, over 300,000 houses. According to the Indonesian Bureau of Statistics, more than 29% of houses in the most heavily affected district of Northern Lombok used Asbestos-cement roofing (Indonesian Bureau of Statistics 2018), which was left broken into small pieces and littered across the entire affected area. This problem

[1] See International Ban Asbestos Secretariat, http://www.ibasecretariat.org/. Accessed 20 October 2021

was then significantly exacerbated by the extensive use of heavy equipment to crush and level building debris to clear the way for reconstruction.

This demolition work led to the circulation of Asbestos in the air during building clearance. It also created a longer-term presence on the ground of small broken pieces of Asbestos cement left from the clearing work (Hodgkin 2020). As a result, those affected by the disaster experienced an additional risk from Asbestos at the time of the disaster and then again during deconstruction and debris removal and now face a continuing longer-term risk from the Asbestos contamination in their surrounding environment.

Dealing with the risk posed by Asbestos post-disaster rests on two approaches: (1) reducing the presence of Asbestos before a disaster and (2) managing Asbestos in a safe manner after a disaster. While programs reducing the presence of Asbestos (often referred to as remediation) are common in a number of countries, the discussion in this chapter focuses specifically using the presence of earthquake, cyclone, flood, or tsunami hazards as a way to prioritize awareness of the risk posed by Asbestos and in planning risk reduction efforts.

## 6.2 Types of Asbestos

The name "Asbestos" is a commercial and legal term encompassing six unique minerals from two distinct silicate mineral groups, serpentine and amphibole. The two groups are easily differentiated by their fibrous structures as serpentine (chrysotile) is curly stranded whereas amphiboles are straight and rod like (Kamp and Weitzman 1999).

The serpentine mineral group includes only one form of Asbestos, chrysotile (white Asbestos), with three almost indistinguishable polytypes. Chrysotile Asbestos comprised more than 90% of global Asbestos production since 1990 (LaDou et al. 2010).

The amphibole mineral group includes further five distinct mineral forms of Asbestos:

- Amosite (brown Asbestos), mostly mined in Africa
- Crocidolite (blue Asbestos), mostly mined in Australia
- Tremolite (sometimes known as green Asbestos) mostly mined in India
- Actinolite and anthophyllite, rarely mined commercially

All amphibole Asbestos are now rarely mined specifically on a commercial scale but still may occur as contaminants in products such as talcum powder and vermiculite.

It is important to note that much commercial claim has been made about the safety of chrysotile (white Asbestos). While amphibole-type Asbestos are generally considered more hazardous, and more commonly banned, scientific reviews by the WHO International Agency for Research on Cancer have concluded that "Cacogenic risks [from Asbestos] apply to [all] these six types of fibres wherever they are found" and "All forms of Asbestos pose grave dangers to human health. All are proven

**Table 6.1** Major Asbestos-producing countries—2020

| Country | Production (metric tons) |
|---|---|
| Brazil | 71,200 |
| China | 120,000 |
| Kazakhstan | 227,000 |
| Russia | 720,000 |
| Zimbabwe | 8000 |
| Total | 1,100,000 |

human carcinogens. There is no continued justification for the use of Asbestos. Its production and use should be banned worldwide" (World Health Organization 2012).

## 6.3 Sources of Asbestos

Selikoff and Lee (1978) provide a historical summary of the minerals covered under the general name of *Asbestos*. Their work notes the use of Asbestos in what is now Finland 2500 years ago, mentions of Asbestos by Greek historians before Christ, and use during the Roman Empire.

Selikoff and Lee (1978) indicate that large-scale mining and use of Asbestos in manufacturing did not increase significantly until the latter part of the nineteenth century. Major mining areas emerged in Australia, Brazil, Canada, China, Cyprus, Greece, Kazakhstan (for a while the Soviet Union), Italy, Russia (for a while, the Soviet Union), Rhodesia (later Zimbabwe), and South Africa (Selikoff and Lee 1978, and Virta 2006).[2]

Extraction and use of Asbestos increased during and after the Second World War. Global production of Asbestos peaked in 1977, at 4.8 million metric tons, dropping to 2.2 million metric tons in 2003 (Virta 2006). While Canada led the world in Asbestos production for decades, by 2020, as indicated in Table 6.1, production was largely limited to five countries and had dropped to approximately 1.1 million metric tons (USGS 2021).

## 6.4 Uses of Asbestos

Asbestos has many uses, from chemical filters to vehicle brake pads, numerous insulation applications, through to reinforcement for a wide range of products used in construction. The Minnesota Department of Health lists 19 categories and

[2] Small levels of production occurred in other countries, but the information available suggests the cited countries have been the most significant producers over time, even as some, e.g., Australia, Canada, have stopped production at present.

69 specific uses of Asbestos (Department of Health n.d.). The Asbestos Awareness web site's Asbestos A–Z Database lists 60 specific uses of Asbestos and provides details of the items identified (Asbestos Awareness n.d.).

Ingham states that Asbestos-cement products consume "70% of world Asbestos production. The range of products includes reinforcing for; wall and roof sheet (corrugated and flat), roof tiles, . . . sewerage pipe, and pressure pipe," reinforcing for glues and tanking compounds used in a range of applications such as fastening PVC flooring, waterproofing roofs, and water tanks (Ingham 2013:126). Virta (2006) states that "The low cost of Asbestos-cement products, their durability and effectiveness, and the relatively unsophisticated technology required to produce Asbestos-cement products were major factors leading to the widespread use of Asbestos cement, particularly for developing countries with limited mineral and monetary resources" (Virta 2006:15).

In addition, though to a lesser extent, Asbestos is used in construction for a wide range of insulation applications such as in pipe lagging, hot or cold water storage, ovens and heaters, as well as loose fluff wall and ceiling insulation. Though the volumes of Asbestos used in these applications are significantly lower, the risk posed can be significantly higher from loose friable Asbestos applications.

The primary interest of this paper is in Asbestos-containing materials which are used in construction, particularly in low-cost, simple housing construction, including:

- Asbestos-cement roofing sheets
- Asbestos-composite wallboard
- Asbestos-containing water and sewage pipes
- Sprayed Asbestos-containing fire protection
- Ceiling and floor tiles
- Asbestos-based pipe insulation and fire-retardant textiles use with, for instance, heating boilers
- Loose fluff insulation

The first two, roofing and wallboard, have a significant durability advantage over metal roofing or wood walls in tropical climates due to the low likelihood of rotting and low long-term maintenance costs.

Table 6.2 lists the major primary users (96% of Table 6.1 production) of Asbestos fibers in 2020 (USGS 2021). The full range of Asbestos use at the county level is difficult to identify or quantify, as noted by Virta (Virta 2006:15). Although, as stated earlier, more than a vast majority of Asbestos use is in reinforced cement building products, the countries in Table 6.2 also likely use Asbestos in items such as brake shoes, Asbestos fabric, and other historical uses, for domestic consumption and, in some cases, for export.

In India, 90% of Asbestos used is reported to be manufactured into Asbestos-cement sheets (Peopels Training and Research Centre 2017:32). Kazan-Allen (2020) reports that 90% of imports of Asbestos into Indonesia were used for construction materials. On the order of 80% of Asbestos imported to Sri Lanka is used for roofing sheets (Colombo Gazette 2016). Similar data for other major users was not available,

**Table 6.2** Major Asbestos use countries

| Country | Use, 2020 (metric tons) |
|---|---|
| India | 310,000 |
| China | 243,000 |
| Russia | 126,000 |
| Uzbekistan | 117,000 |
| Indonesia | 86,200 |
| Sri Lanka | 48,200 |
| Vietnam | 36,400 |
| Thailand | 35,000 |
| Bangladesh | 28,900 |
| Kazakhstan | 25,700 |
| Total | 1,056,000 |

but, as noted above, a significant part of the Asbestos used is likely to be incorporated into Asbestos-cement products (Ingham 2013).

While Asbestos-cement construction materials have advantages in tropical environments, not all tropical countries have used Asbestos widely. For instance, a survey in Fiji did not observe Asbestos-containing products present in 3600 houses assessed. In the Republic of the Marshall Islands, a survey of over 4600 houses found only 1 with Asbestos-containing materials (PacWaste n.d.).

In sum, Asbestos has been used for centuries, but most industrial uses have been in the last 150 years. Production has dropped significantly since 1977. Currently there are five major producing and ten major using countries. While Asbestos has been used as a component in many materials, Asbestos mixed with cement, and particularly for roofing and wall panels, has been a significant part of all Asbestos-based use.

## 6.5 Asbestos as a Hazard

While in the ground, Asbestos does not pose a significant hazard. The mineral becomes an active hazard when fibers become active in the environment, far more so when airborne.

Asbestos fibers becoming airborne may happen during mining, transport, processing, or the manufacturing of products which contain Asbestos fibers. Asbestos fibers can also become active in the environment, during construction and maintenance or as a result of damage to Asbestos-containing products such as Asbestos-cement roofing and wall sheets.

The threat posed by Asbestos can also arise from Asbestos released from clothing which has been contaminated during direct exposure to Asbestos from any of the activities noted above (Frank and Joshi 2014). As a result, the Asbestos hazard exists not only where Asbestos initially becomes airborne but also in locations where persons initially exposed to Asbestos fibers may travel, e.g., from a factory using Asbestos to living quarters.

Health risks associated with Asbestos exposure generally include reduced lung function and consequent physical disability, with other negative outcomes including skin abnormalities, specific types of cancers, and issues with the gastrointestinal and pro-pharyngeal body systems (Frank and Joshi 2014:259). A particular challenge with Asbestos as a hazard is that most associated health impacts involve decades-long delay between exposure and the presentation of significant symptoms. Also of concern is that many of the health risks associated with Asbestos, such as mesothelioma, are fatal with no known cure (Frank and Joshi 2014).

This delay means that exposure may occur long before the person exposed is aware of the impact of the hazard and long after mitigation measures should have been taken. The delayed onset of symptoms poses an additional significant challenge in the humanitarian context, where the rush to address urgent and immediate lifesaving measures may override less apparent long-term risks such as that posed by Asbestos. This may be true both for the affected community and for those coming to assist.

Significantly, there has been no minimal safe level of exposure established below which negative health outcomes do not occur. Exposure to a single fiber can be sufficient to cause Asbestos-related diseases such as mesothelioma (Frank and Joshi 2014:260). As a result, when dealing with Asbestos abatement or processing Asbestos-contaminated disaster debris, no level of airborne Asbestos fibers is considered acceptable. Meeting this standard requires a level of control over the handling of Asbestos-containing products and protection of workers and downwind populations which are as rigorous as would be used to deal with highly toxic chemicals. Meeting this standard in the immediacy and sheer scale encountered in humanitarian crisis poses an even more significant challenge.

The chronic nature of Asbestos health outcomes, and the delay with which these outcomes can occur, can be particularly challenging in societies without strong social safety nets, worker safety systems, and extensive healthcare services capable of long-term care for those with chronic diseases. The delayed onset of Asbestos-related illnesses poses a challenge in risk communication and the uptake of risk reduction measures. This is especially true where the persons are already coping with the impacts of a large-scale crisis and are at risk from other, more immediate potential threats, for instance, food insecurity or living in a flood or landslide zone.

Remediation, that is, the safe removal and disposal of Asbestos, has been initiated in a number of countries. However, the cost of remediation is not insignificant.[3] The procedures involved, including personal protective equipment and sealing areas where Asbestos is removed, safe transport systems, and appropriate disposal sites are complicated, require significant training and enforcement, and are therefore often procedurally demanding.

The risks posed by Asbestos have now been recognized in a significant number of countries, leading to a complete ban in at least 67 countries, with a range of

[3] Cost estimates of \$12.86/ft$^2$ (.09m$^2$) to \$24.97/ft2 (.09 m2) are reported for the United States in test cases of total demolition (2009 USD) (Wilmoth et al. 2009).

**Table 6.3** Major Asbestos-using countries and earthquake, cyclone, flood, and tsunami hazards

| Order of use in 2020 (USGS 2021) | Country | Hazard present | | | |
|---|---|---|---|---|---|
| | | Earthquake | Cyclone | Flood | Tsunami |
| 1 | India | X | X | X | X |
| 2 | China | X | X | X | X |
| 3 | Russia | X | | X | X |
| 4 | Uzbekistan | X | | X | |
| 5 | Indonesia | X | X | X | X |
| 6 | Sri Lanka | | X | X | X |
| 7 | Vietnam | | X | X | X |
| 8 | Thailand | | X | X | X |
| 9 | Bangladesh | X | X | X | X |
| 10 | Kazakhstan | X | | X | |

restrictions in many others (Frank and Joshi 2014:261). The International Ban Asbestos Secretariat[4] leads efforts to, as the name suggests, ban Asbestos.

At the same time, while the production and use of Asbestos was, in 2020, on the order of 23% of peak levels, over 1 million tons were still being processed into products, primarily Asbestos-cement products, based on Ingham (2013). In addition, while the global use of Asbestos may be reducing, this is not true for all countries, and, in most countries, little has or is being done to reduce the accumulated volume of Asbestos in the built environment, much of it incapsulated in aging buildings. As a result, the scope of the Asbestos hazard and the number of people who could be exposed to Asbestos post-disaster continue to increase.

The presence of hazards which damage the built environment, particularly earthquakes, cyclones (typhoons, hurricanes), floods, and tsunamis, increases the risk of releasing Asbestos. As indicated in Table 6.3, each of the top ten Asbestos-using countries is subject to two or more of these hazards.

Table 6.3 does not include countries which have had significant use of Asbestos, but no longer produce Asbestos-based materials used in construction. As a result, while Table 6.3 indicates countries where Asbestos-related risks are increasing due to more use of Asbestos, a significant number of countries also face a significant risk from past Asbestos use.

An additional consideration is that countries which use Asbestos may face challenges in enforcing building codes, use of codes which do not adequately consider the impacts of storms or earthquakes, or both. As a result, there is an increased risk of the release of Asbestos at events which have lower intensity than if more hazard-appropriate codes existed or were enforced.

Clearly, not all parts of the countries in Table 6.3 or former Asbestos-using countries, are subject to earthquakes, cyclones, flooding, or tsunami or that Asbestos products are present in the zones where these hazards exist. Risk mapping, looking at (1) the presence and scale of use of Asbestos, (2) earthquakes, cyclones, flooding, or

[4] http://www.ibasecretariat.org/. Accessed 20 October 2021

tsunami impact zones, (3) likely damage from possible hazard events, and (4) the levels of social and economic vulnerability, is essential to identifying where work to reduce Asbestos-related risk is needed and the priority of this work.

A partial example of this type of effort has taken place in the South Pacific. The *State of Asbestos in the Pacific* (PacWaste n.d.) provides an assessment of Asbestos presence in residential and non-residential locations in the Cook Islands, Fiji, Federated States of Micronesia, Kiribati, Nauru, Niue, Palau, Republic of Marshal Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. While, in theory, more detailed mapping of the presence of Asbestos in hazard zones could be done for each country, this would likely only be needed for larger countries such as the Solomon Islands or Vanuatu where information about Asbestos use in specific locations across the country may be necessary to compare local risks.

The data in the report allows for a ranking of countries in terms of risk and the identification of several as having a relatively low Asbestos presence and thus low risks. In fact, data from PacWaste was used following the Cyclone Gita in Tonga to identify Asbestos as a significant issue in disaster debris management (WWF US 2018).

In summary, Asbestos is a significant health risk when humans are exposed, through mining, processing, and handling Asbestos-based products. This risk involves both very low thresholds of exposure and a considerable delay before damage to health is evident (Frank and Joshi 2014). (Apart from the release of Asbestos in extreme events, research is also needed in releases through normal degradation of Asbestos-containing products.)

Asbestos production has decreased significantly from a peak in 1977. Yet, as of 2020, ten countries were using over 1 million metric tons of Asbestos per year. Despite long-term reductions in the production of Asbestos, continued mining and manufacturing of Asbestos-based products and the historical high level of use of Asbestos created a significant and compounding threat from this mineral.

Earthquakes, cyclones, floods, and tsunamis which damage buildings and other infrastructure can be expected to lead to a release of Asbestos fibers if Asbestos has been used in construction, even decades ago. With the exception of the South Pacific, only limited information is available on the presence of Asbestos-based materials in earthquakes, cyclones, flood, and tsunami hazard zones. Each of the ten countries listed in Table 6.3 as currently using Asbestos has two or more of these hazards present, leading to a significant threat from Asbestos fiber releases when these hazard events occur.

## 6.6 Reducing the Asbestos Threat from Earthquakes, Cyclones, Floods, and Tsunamis

### *6.6.1 Elements of Disaster Risk Management*

The conceptual process of reducing disaster risk is based on four core components (adapted from Office for Outer Space Affairs n.d., and Royal Institution of Chartered Surveyors 2009):

- *Risk reduction*, often based on an assessment of risk and bridging between disaster response and development interventions, where development interventions should, implicitly, reduce risks and response includes risk reduction.
- *Preparedness*, including early warning, focused on planning for the best possible response to a disaster once it occurs and (in some circumstances) including actions to reduce the need for response (implicitly reducing risks).
- *Response*, ranging from actions to avoid damage immediately before a disaster (e.g., evacuation) to lifesaving actions and what may be called life-sustaining actions (e.g., providing food, shelter, water, etc.) during and after a disaster where disaster survivors do not have access to these basic needs.
- *Recovery*, a process which begins during the response and continues for years to re-establish normal society. Recovery should include risk reduction, to build back in a way that reduces the potential for disasters in the future.

### *6.6.2 Preparedness and Risk Reduction*

This section combines preparedness and risk reduction for two reasons:

1. Reducing risks and preparing to manage Asbestos after a disaster are unlikely if the at-risk populations are not aware of the risk posed. In practice, it is the same awareness raising about Asbestos which is necessary for preparedness and risk reduction work, so these efforts should be combined.
2. The assessment of the scale and scope of possible Asbestos risk, when combined with earthquake, cyclone, flood, and tsunami hazards, is needed for both preparedness (identifying where specific Asbestos-and-other-hazard overlaps exist) and risk reduction (identifying where to prioritize risk reduction).

In this sense, combining risk reduction and preparedness reduces the workload in each area.

The first step in disaster-related Asbestos risk reduction and preparedness is a risk assessment covering the

1. Risks (hazard recurrence and scope of vulnerability/damage) from natural hazards that may cause building damage, such as earthquakes, volcanic eruption,

cyclones, tornados, floods, landslides, liquefaction, tropical storms and strong winds, and tsunamis
2. Presence and type of Asbestos-containing products and how they can be released in the case of one of the natural hazards covered in the assessment.

A lower level of assessed disaster-related risk does not automatically mean that the overall Asbestos risk itself is low. This assessment only refers to the release of Asbestos following a disaster which damages the built environment. The type of Asbestos, the manner of use, the level of human contact, age of the material, and other factors may create a high level of risk from Asbestos independent of other hazards.

In conflict-prone areas, an additional risk assessment and preparedness/response strategy may be required to assess the potential hazard caused by damage to buildings containing Asbestos. At the time of writing this chapter, the conflict in Ukraine presents significant risk of exposure to Asbestos (Ukraine Environmental Study Group 2022).

Countries are currently being encouraged to develop disaster risk assessments,[5] although the scale of these assessments can vary from very local to very broad in detail. Taking a page from the PacWaste effort (PacWaste n.d.), an initial step can be to do a census of the type and location of Asbestos products. As stated previously, the vast majority of Asbestos is used for reinforcing in construction materials; therefore, much of this data may be readily available from construction census and/or building approval data (as was found in Indonesia during the Lombok response). This information can then be overlain with risk information for natural hazards. Additional overlays such as poverty and house, land, and property rights may then provide further guidance as to quality of construction and therefore vulnerability of buildings to hazards.

Results of the disaster-Asbestos risk assessment have a number of uses. First, once identified, this risk can be easily incorporated into national and provincial preparedness and contingency planning processes. Second, as noted above, the assessment results can then be used to develop specific Asbestos preparedness plans, including preparing teams and capacities to manage Asbestos-associated disaster debris.

Third, assessment results can be used to develop prioritized risk reduction plans to reduce the presence of Asbestos-containing materials starting with the locations of highest risk. This effort may be similar to normal Asbestos remediation efforts but expand into (1) raising awareness at all levels as to the risk posed by Asbestos, particularly in the case of earthquakes, tsunami, and similar events, (2) improving access to alternative materials with which to replace Asbestos-containing materials, (3) providing financial support for a replacement process, and (4) training and providing long-term support to teams which would do the replacement work and assure safe disposal of any Asbestos-containing materials collected.

[5] See Words into Action guidelines: National disaster risk assessment https://www.undrr.org/publication/words-action-guidelines-national-disaster-risk-assessment, Accessed 15 November 2021.

An example of this type of effort comes from Indonesia. The Indonesian Shelter Coordination Support Team (ISCST) was able to get Asbestos banned in the Central Sulawesi Province, and Indonesian Ban Asbestos Network[6] managed to get its use banned in West Java Province. The Indonesian Shelter Coordination Support Team also produced guidelines on Asbestos for Aid Agencies, to protect their staff and those they are assisting. These guidelines have been adopted by the Indonesian Humanitarian Country Team (HCT) as minimum guidelines for all HCT members and by the Ministry of Social Affairs for all organizations working under the auspices of the National Protection and Displacement Cluster. In addition, the ISCST produced videos, posters, and flyers ready for rapid deployment in future disasters to explain the risk.

The complexity of developing risk reduction plans should not be underestimated, particularly where Asbestos use remains legal with more than the content of this chapter needed to address all the relevant challenges. This said, work to replace Asbestos-containing materials can be combined with other risk reduction measures such as structural reinforcement, strengthening roof structures, and raising and relocating buildings, usually part of earthquake, cyclone, flood, and tsunami risk reduction measures.

Finally, but certainly not least, the risk assessments can support efforts to engage in a significant level of awareness raising, and what could be called marketing and sales, to convince at-risk populations that reducing or banning the use of Asbestos and changing to other materials is a good idea and that improving encapsulation can be done safely and is important for the safety of their family.

Removal and replacement is also a good idea, particularly if undertaking renovations. But it is essential that trained professionals utilize the correct safety procedures and safety equipment.

Such an effort would be needed for:

- Preparedness, to ensure those at risk can safely manage Asbestos-containing materials after a disaster
- Risk reduction, to assure understanding of the risk posed by Asbestos and creating a willingness to reduce the Asbestos-disaster risk despite inconveniences involved

A final challenge in reducing the risk of the presence of Asbestos-containing materials in earthquake, cyclone, flood, and tsunami hazard zones is prioritizing where these efforts should begin. Two negative, two positive, and two scaling criteria are proposed for use in this targeting process:

- Negative
  - Where Asbestos use continues and any of the above identified potential hazards (e.g., earthquakes) are likely

[6] http://inaban.org/

  - Where Asbestos has been used on a significant scale and any of the above potential hazards (e.g., earthquakes) are likely
  - Where building quality and building code enforcement are low

- Positive
  - Where Asbestos remediation measures are already underway and likely to continue
  - Where earthquake, cyclone, flood, and tsunami risk reduction measures are underway and which would reduce the presence of Asbestos in the normal course of effort

- Scaling
  - The level of damage to the built environment from earthquakes, cyclones, floods, or tsunamis over the next 30 years, based on the expectation (a) that Asbestos-based building materials will remain largely in a functional state (i.e., not replaced) for this period and (b) that disasters during this period will cause significant damage to Asbestos-containing materials
  - The number of persons at risk from one or more of the four hazards (earthquake, cyclone, flood, and tsunami) where Asbestos-containing materials have been used, with the greater at-risk population, the greater need of risk reduction

Resources available in developing the chapter did not allow for a global level assessment of where Asbestos preparedness and risk reduction should be targeted based on these criteria. However, based on the *State of Asbestos in the Pacific* report (PacWaste n.d.), Asbestos-disaster risk preparedness and risk reduction would be needed for only a few of the South Pacific. In contrast, the ongoing use of Asbestos in the countries in Table 6.3 suggests they could be a focus of risk reduction efforts.

What is unknown from the available research is the level of Asbestos-disaster risk in countries where Asbestos has been, but is not longer, used. Identifying these countries and assessing levels of risk related to earthquakes, cyclones, floods, and tsunamis are a critical next step in reducing the risk posed by Asbestos during earthquakes, cyclones, floods, or tsunamis.

### 6.6.3 Asbestos-Aware Response and Recovery

Awareness of Asbestos as a significant post-disaster issue has increased in the international humanitarian assistance community in recent years. The response to Asbestos as part of relief and recovery after Cyclone Idai and other disasters was discussed at the Asbestos and Humanitarian Response—A Life-Threatening Humanitarian Challenge session during the 2020 Humanitarian Networks and Partnerships Week (UNEP/OCHA Joint Environment Unit 2020).

Experiences in managing Asbestos in countries which have banned or restricted the use of Asbestos and have undertaken Asbestos removal programs have been transformed into guidance for use in humanitarian assistance operations. A sample of this guidance, from UNEP/OCHA Joint Environment Unit (2020), includes:

- Asbestos Essentials: Equipment and Method sheets (Health and Safety Executive UK 2017)
- Review of Asbestos Management Practices in Disaster Planning (Government of Australia 2017)
- Disaster Waste Management Guidelines (UNEP/OCHA Joint Environment Unit 2011)
- A Brief Guide to Asbestos in Emergencies: Safer Handling & Breaking the Cycle Shelter Centre and the ProAct Network (2015)

With the fast pace of relief and recover operations, this type of guidance needs to be incorporated into pre-disaster planning and training and the localization of operational capacities.

In addition, experts are available after disasters through the UN system to assess Asbestos risks and develop management plans. Frustratingly, engaging such consultants to support post-disaster management of Asbestos can be long and cumbersome. As a result, building capacities in disaster-prone areas to properly manage Asbestos before a disaster is a critical requirement to address the problem post-disaster.

Although guidance and technical support on safely managing Asbestos after a disaster is available, the actual management of Asbestos in the humanitarian response confronts several challenges. First is the cost and availability of international standard PPE for teams dealing with Asbestos, estimated at $7 to $15 per day per person (UNEP/OCHA Joint Environment Unit 2020). In addition, there are costs associated with the packaging and transport and (in some cases) paying for placing Asbestos-containing materials in a disposal site. Overall, the cost of addressing Asbestos after a disaster can be significant when compared to the funding which might be available.

This is often because humanitarian operations usually receive significantly less than identified funding requirements. As an example, funding for UN-managed humanitarian operations from 2011 and 2020 ranged from 52% to 65% of funding requested. On average, between 2016 and 2018, 10% of appeals received 25% or less funding, with more funded above 25% in 2019, with one third of appeal receiving less than 25% funding in 2020 (Development Initiatives 2021).

In addition, funds for humanitarian response are commonly constrained to actions that address urgent lifesaving needs. The delayed onset of Asbestos-related illnesses makes it difficult for humanitarian donors to prioritize this issue over more apparent and immediate needs such as food, water, and shelter.

On the other hand, the much larger pool of development funds often stipulate that they are not to be used for humanitarian response and require much longer lead times to access. This funding gap between the *Humanitarian Purse* and the *Development Wallet* is a continual challenge in funding risk reduction and the transition from short-term life-saving relief to the more complex and expensive recovery.

Inadequate funding leads to difficult decisions as to what available funds should be spent on. The relative high cost and further-in-the-future impact of managing Asbestos mean it is likely not prioritized in the face of more immediate life-threatening requirements. Even if funding were to be available, many humanitarian agencies do not have dedicated capacities to deal with the complexities of managing Asbestos. As well, the threat posed to agency staff from Asbestos and cost associated with reducing this threat further exacerbate funding issues.

While humanitarian assistance programs may form and train teams to manage the Asbestos hazard after a disaster, the sustainability of these teams is often an issue. This is particularly the case where:

- No Asbestos remediation programs exist in the country, creating a gap in the long-term institutional basis for the work of the teams, particularly in countries where Asbestos has been deemed to be safe and continues to be legal for sale with no safe disposal requirements that may otherwise support or maintain the investment in training up mediation teams
- Asbestos management is not clearly integrated under one of the Clusters[7] or similar structures used to guide and coordinate humanitarian assistance. Although often of significant concern to Clusters such as Shelter and Health, coordination of Asbestos mitigation and cleanup activities often lands at the feet of the Early Recovery Cluster which is generally implemented through a series of sub-topical coordination working groups, focused on issues to which multiple agencies are responding and therefore require enhanced coordination, such as rubble clearance, waste management, building inspections, etc. Without multiple agencies focusing on Asbestos, there is often little pressure to form a working group dedicated to the issue.
- Cleanup and disposal efforts often also encounter significant regulatory hurdles such as mismatched or unclear laws on safe removal, mediation, transport, and disposal, on which to base their work.
- Programs may also face a lack of approved PPE, authorized transport vehicles, or officially designated and/or appropriate Asbestos disposal sites.

There may be limited or no awareness on the part of the disaster affected or those managing relief and recovery of the risk posed by Asbestos. In fact, unless both survivors and assistance providers are aware of the Asbestos risk, it will be hard to implement successful risk reduction efforts. This problem can be further exacerbated by past or active (mis)information campaigns by pro-Asbestos lobby groups, directly countering the public education and awareness campaigns from humanitarian actors.

A lack of awareness amongst humanitarian responders is often further exacerbated by the high turnover in the humanitarian sector, a boom-and-bust industry with relatively few positions in most agencies funded beyond the immediate response.

[7] A “Cluster” is a part of the humanitarian assistance coordination system, with each Cluster focusing on a specific sector or post-disaster intervention, e.g., shelter, health, or education.

This means that many new staff lack awareness of Asbestos as a continuing and growing issue of concern across the sector.

Unsurprisingly, local staff newly engaged in countries where Asbestos-containing products are still legal for sale often have little or no awareness or understanding that such products pose a significant threat. New staff brought in as surge capacity from the *Global North* may be from countries where Asbestos was banned as long ago as the early 1980s. As a result, they may have little knowledge or experience of Asbestos risk in their lifetime and may not imagine that the reinforced cement products around them would or could contain Asbestos.

And, as in the Lombok case, efforts at speeding recovery by bulldozing damaged buildings containing Asbestos can greatly increase the scale of contamination in areas where survivors were living (Hodgkin 2020). Such actions which do not consider the Asbestos risk not only significantly worsen this risk and contribute to greater potential negative outcomes over the long term; they also significantly increase the challenge for effective cleanup and mitigation.

Finally, awareness building and operational plans need to strongly encourage a rebuilding process which does not use Asbestos-based products. This includes three significant challenges: (1) tackling the tendency for households to reuse broken and damaged sheeting that they still see as a valuable resource, in emergency, temporary, or permanent reconstruction; (2) convincing both government and non-government humanitarian actors to ban the use of new Asbestos materials in all their emergency and transitional relief programs; and (3) tackling the desire to use new Asbestos-containing products in permanent reconstruction programs.

The last two of these steps can face significant challenges in countries where Asbestos-containing products are still legal for sale and where Asbestos suppliers view the reconstruction efforts as a major business opportunity. Marketing campaigns on the benefits of Asbestos-reinforced building products after disasters highlight the low cost, high strength, light weight, heat and rain resistance, ease of construction, and relative safety (in the moment of a disaster) of reinforced cement products.

As demonstrated in the Lombok case, pressure to move forward in recovery and quickly remove debris and damaged buildings may lead to an unintended, and significant, increase in the risk from Asbestos. In most cases, this risk will be borne by those who have just experienced a disaster, and/or are responding to it, and thus add to the long-term impact of this disaster.

## 6.7 Conclusions

This chapter has provided an overview of the risks posed by Asbestos-containing materials (particularly construction materials) when they are subject to damage or destruction following earthquakes, cyclones, floods, or tsunamis. As Asbestos production and use continue, these risks are increasing. There also is a significant risk from Asbestos in countries which had used but no longer use Asbestos for construction as Asbestos-containing materials can be expected to not degrade quickly under natural conditions.

The chapter identifies how the Asbestos-disaster risk can be managed in the disaster relief and recovery phases, but also highlights that these efforts may require long-term commitments that are not easy to sustain in some countries. The chapter closes with a description of how a reduction of the risk posed by Asbestos after a disaster can be addressed through preparedness and risk reduction, including the important requirement to raise awareness of at-risk populations as to the need to reduce the long-term threat from Asbestos-containing materials.

Going forward in addressing the Asbestos-disaster risk requires (1) risk assessments overlapping earthquake, cyclone, flood, or tsunami hazards and Asbestos-based product use, (2) raising awareness of the threat posed by Asbestos, and (3) prioritizing where to intervene based on six criteria defining the size of the population at risk and whether efforts are underway to reduce the risk from Asbestos release during disasters.

Enough is known about the risk from Asbestos alone and the combined Asbestos-disaster risk. Action is needed to reduce this risk using the approaches and processes set out in this chapter.

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